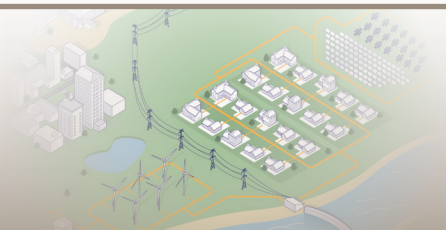
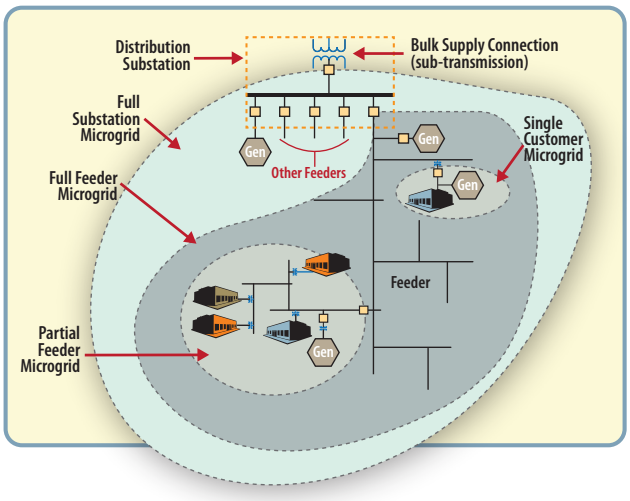
Microgrid Design Toolkit (MDT)



A Toolkit for Microgrid Design

To ensure safety, security, and well-being, critical installations require a steady supply of power at all times, with no interruptions. Microgrids—collections of distributed energy resources and controls that can provide electrical power independently of the primary grid—offer a means of maintaining power, even when the grid is unavailable. To aid in optimal design of microgrids, and help avoid potential problems with maintenance, safety, power quality, and stability, Sandia has developed the Microgrid Design Toolkit (MDT).

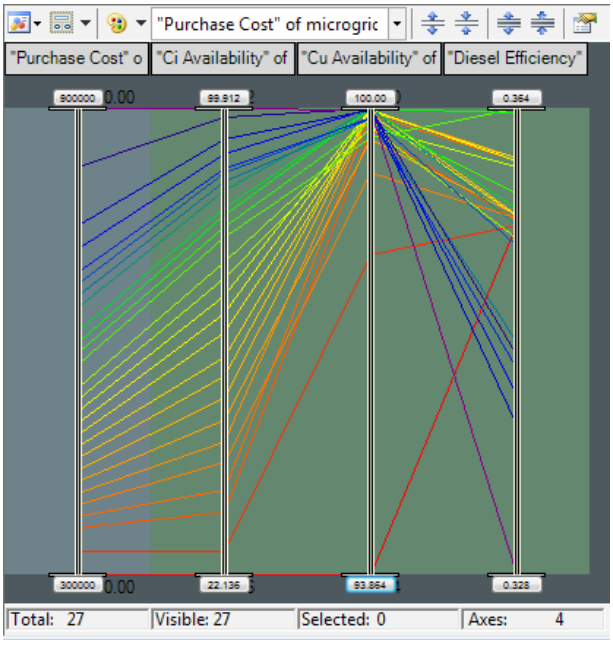


MDT is decision support software that can provide designers the information they need to identify an optimal microgrid design for their needs in the early stages of the design process. Employing powerful algorithms, MDT searches the trade space of alternative microgrid designs in terms of user-defined objectives, such as performance, reliability, and cost. It then produces a Pareto frontier of efficient microgrid solutions—or, the efficient tradeoffs that can be made among multiple user-defined objectives. A range of interactive displays and charts help designers understand the implications of different decisions and tradeoffs on the quality of a microgrid design.

Versatile Design Support

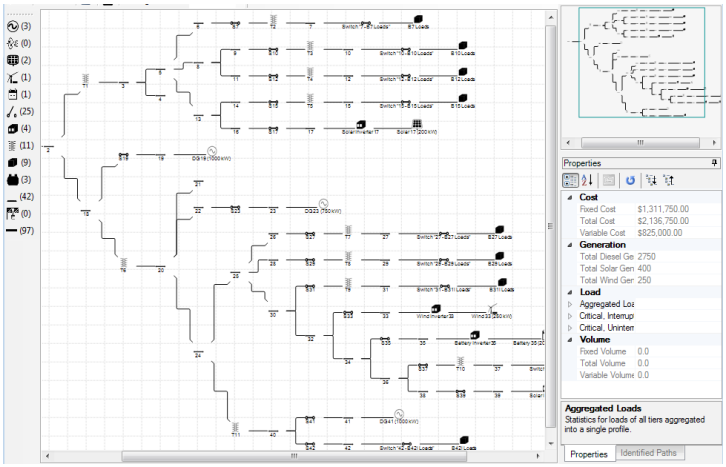
MDT can help designers with a number of important activities:

- Identify efficient alternatives from a very large design space
- Reduce the number of design considerations by eliminating undesirable features early on
- Investigate the simultaneous impacts and tradeoffs of several design decisions
- Obtain a rich set of performance statistics, as well as energy and asset reliability calculations, for each design
- Gain defensible, quantitative evidence for decisions
- Perform what-if analysis by altering the input for a run of the solver without loss of information
- Test hypotheses by manually generating solutions and comparing them to the solutions found by the MDT



Input Features to Identify Optimal Solutions

Several input features give designers multiple



options for rapid but comprehensive analysis of alternatives to find optimal design solutions:

- An extensive set of input validation checks with detailed error descriptions and navigation support
- A separate asset specification database that can be reused from analysis to analysis
- Ability to select and group metrics for optimization and tradeoff analyses

In addition, fixed and variable input options help users find answers to a range of questions. For example, users can learn whether it would be advantageous to replace a generator, and if so, the optimal size and type of the replacement.

Output Features to Explore Options

Views and features provided by MDT help designers more fully explore the trade space to answer important questions, such as the following:

- What solution characteristics perform well along a particular tradeoff dimension?
- What technology decisions have been ruled out as undesirable?
- What is the cost of realizing a 10% performance improvement over that of a baseline solution?

MDT is already building a track record in the design and assessment of microgrid projects. For example, it was used in early design of a backup power system in Hoboken, New Jersey, to ensure a steady supply of power to critical infrastructure, such as hospitals, fire stations, and city hall, in the event of manmade or natural disasters. MDT was also instrumental in the work of the Smart Power Infrastructure Demonstration for Energy Reliability and Security (SPIDERS) program, which created microgrids to ensure that three different military installations can operate independently from the power grid for extended time periods with maximum assurance of uncompromised electrical service.

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